FINAL TECHNICAL REPORT FOR NAG 5 1206

"THE THREE-DIMENSIONAL NATURE OF ATMOSPHERIC DYNAMICS AND TRANSPORT VARIATIONS IN STRATOSPHERIC STRUCTURE AND COMPOSITION"

Marvin A. Geller - Principal Investigator

In my original proposal to the NASA Goddard Space Flight Center for this project, three principal tasks were proposed. In the following, progress on these topics will be reviewed. There will also be some discussion of additional work that was undertaken during this period.

Task #1: *"... write up a paper describing the relations between the eight years of calculated residual circulation, and temperature, and ozone."*

In my Semiannual Progress Report for the Research Grant NAG 5-1206 to Dr. R. Rood, the Technical Officer for this grant, I indicated that a draft manuscript had been written on this topic and circulated to my collaborators at GSFC. I also indicated that another draft would be prepared and submitted for publication.

Appendix I to this Final Report is the draft that now exists on this topic. I am awaiting comments from my collaborators at GSFC before submitting it for publication. I plan on submitting it to the Journal of the Atmospheric Sciences before Christmas.

Task #2: *".. compare ozone transport calculations carried out with an assimilated data set with transport calculations carried out using geostrophic calculations.*

This has been done. Some of the calculations that were done for this study were included in a paper titled, "Three-Dimensional Simulations of Wintertime Ozone Variability in the Lower Stratosphere," by Rood et al. that has been accepted for publication in the Journal of Geophysical Research. In particular, this paper contained comparison of ozone flux terms calculated from a transport-chemistry model using the assimilation winds and temperatures with the same flux terms using the assimilation winds and LIMS ozone amounts.

The decision remains to be made whether or not to submit a separate paper on the more complete set of flux calculations that have been carried out. These include geostrophic calculations from the NOAA temperatures together with the SBUV ozone, geostrophic calculations from LIMS temperatures and ozone, assimilation winds together with LIMS ozone, and calculations from the transport-chemistry model.

Task #3: " .... compute trajectories of a number of air parcels at various points in the stratosphere using the assimilated data set."

As was mentioned in my semiannual report, this task was deferred in favor of studying the change in information content that results from satellite sampling and mapping. In a cooperative effort, a video animation comparing modeled ozone with that which would be observed and mapped from satellite was made. This was originally done at 30 mbar. We have also done the same "satellite observation" and mapping at 10, 6, 3.5, and 2 mbar where the ratio of the photochemical time scales to those of transport decreases as a function of altitude. An animation will also be made showing these results. This work will be written up shortly.

A paper was also written in response to an invitation to comment on recent results on suggestions of solar effects on the atmosphere. This paper (Geller, 1989) appeared in Nature.

Finally, a supplement was added to this grant to facilitate my attendance at UARS Science Team meetings until this funding was in place. These meetings were attended. This funding is now in place.

No inventions or patents have resulted from this research.

References

Geller, M. A., 1989: Atmospheric Circulation - Variations without forcing. Nature, 342, 15-16.

Geller, M. A., E. R. Nash, M.-F. Wu, and J. E. Rosenfield, 1990: Residual circulations calculated from satellite data: Their relations to observed temperature and ozone distributions. To be submitted to J. Atmos. Sci..

Rood, R. B., A. R. Douglass, J. A. Kaye, M. A. Geller, Y. Chi, D. J. Allen, E. M. Larsen, E. R. Nash, and J. E. Nielsen, 1990: Three-dimensional simulations of wintertime ozone variability in the lower stratosphere. To appear in J. Geophys., Res,